

To inspire the next generation of explorers . . . as only NASA can.

INTRODUCTION

NASA's Space Science Enterprise is one of the primary organizations responsible for carrying out NASA's goal to "explore the Solar System and the Universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere." The Space Science Enterprise is also strongly committed to supporting NASA's goals to "inspire and motivate students to pursue careers in science, technology, engineering, and mathematics," and to "engage the public in shaping and sharing the experience of exploration and discovery." These science and education goals are addressed simultaneously by embedding education and public outreach (E/PO) efforts within every NASA space science mission and research program.

In Federal fiscal year (FY) 2003, nearly 100 NASA space science missions and research programs conducted E/PO programs. This Annual Report summarizes those E/PO efforts as well as the E/PO efforts carried out through special purpose educational programs such as the Initiative to Develop Education through Astronomy and Space Science

(IDEAS) program and the Minority University and College Education and Research Partnership Initiative (MUCERPI) in Space Science. It also includes contributions from projects coordinated or initiated by the NASA Space Science E/PO Support Network. In total, 115 missions, research programs, and special purpose programs contributed to the E/PO efforts described in this report.

Examples of the E/PO efforts covered include award-winning educational Web sites, major exhibitions in museums and science centers, partnerships with minority universities, resources for educators, research projects that allow students and teachers to participate in NASA space science missions, and Webcasts and public television broadcasts about major space science research areas. Throughout FY 2003, there was an emphasis on continually making E/PO more prominent within the NASA space science program and more cohesive with NASA's overall education program, expanding the reach of the Space Science E/PO Program to include an increasingly broader and more diverse variety of participants, and paying greater attention to the coherence and impact of these E/PO efforts.

In total, efforts centered on developing 476 E/PO products and activities are summarized in this report and include the following:



Caption: More than 5,000 E/PO events took place under sponsorship of the Space Science Enterprise in FY 2003, encompassing all 50 states, the District of Columbia, and Puerto Rico. (Credit: Southeast Regional Clearinghouse/Craig Anthony)

- 55 new educational products registered with the [Space Science Education Resource Directory \(SSERD\)](#) during FY 2002;
- 194 educational activities that directly supported classroom education;
- 37 activities emphasizing targeted outreach to specific audiences or addressing special needs within the education community;
- 43 activities providing support to science centers and planetariums;
- 136 educational activities directed at reaching the general public; and
- 11 activities aimed at encouraging members of the space science community to contribute to E/PO activities, and increasing the effectiveness of such efforts.

Taking into account the fact that many of the activities reported involved multiple events that took place in a variety of venues, the total number of E/PO events reported for FY 2003 is more than 5,000—more than a 40 percent increase over the number of events reported in FY 2002. Events took place in all 50 states, the District of Columbia, and Puerto Rico.

While accurate information on the numbers of participants in these events is difficult to gather, we can offer the following estimates:

- Over 390,000 teachers, students, and members of the general public were direct participants in OSS-sponsored workshops, community and school visits, and other interactive special events, either in person or via live, two-way communications links.
- Over 3 million visitors came to museum exhibitions, planetarium shows, public lectures, and special events featuring content from OSS missions and research programs.



E/PO is an integral part of each space science mission. (Credit: NASA Space Telescope Science Institute)

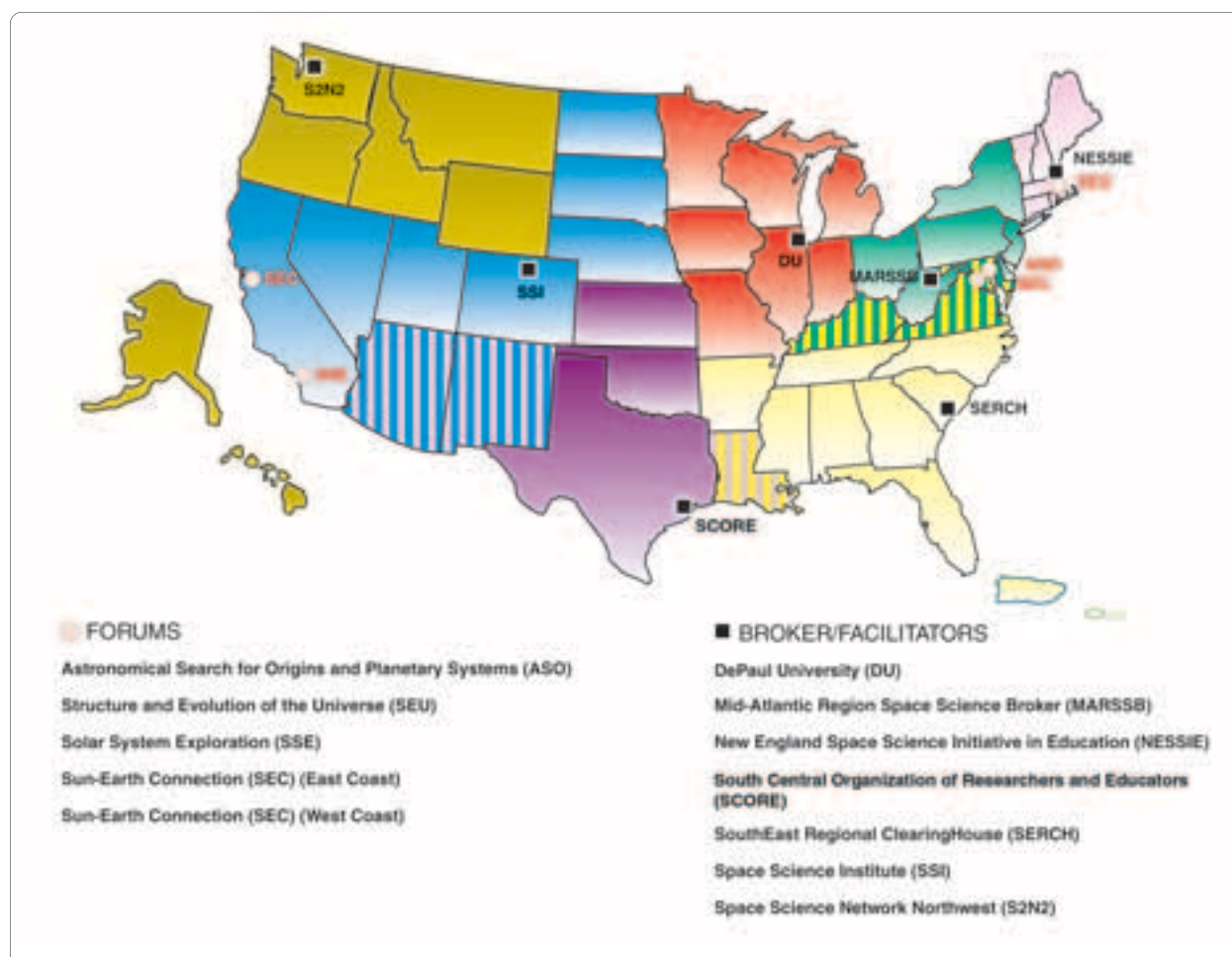
- Over 6 million Internet users logged in for Webcasts, Web chats, and other Web events.
- OSS materials and programs were made accessible to some 200 million people through conferences at which there were OSS exhibits or displays, radio and television broadcasts, newspaper columns, or other forms of public media for which precise counts of attendance, viewing audience, or readership were not available.

Complete information on each of these products and activities, including event dates, locations, and participant counts, appears in appendix A. Summary comments and descriptions of some highlights are contained in the narrative below.

The Space Science E/PO Program is aligned with and strongly supports the NASA mission to **“inspire the next generation of explorers . . . as only NASA can”**. During FY 2003, the Space Science Enterprise was a strong participant in developing NASA's Education Strategy. In addition, E/PO concerns played a prominent role in the development of the 2003 Space Science Strategy (available at <http://spacescience.nasa.gov/admin/pubs/strategy/2003/index.html>). In November 2002, a team of eight nationally recognized educators joined more than 100 members and stakeholders of the space science community for the triennial Space Science Enterprise Strategic Planning Workshop, held in Mission Bay, CA. As a result, E/PO plans and strategies are embedded throughout the 2003 Space Science Strategy, and each science theme's section in the strategy contains a full-page display of E/PO efforts emanating from the research missions and programs in that theme.

The most significant and unique resources that the Space Science Enterprise can bring to E/PO efforts are the results from space science missions and research programs, and the scientific and technical expertise of the space science community. A description of the E/PO program carried out by each NASA space science mission and research program in FY 2003, along with references to the specific E/PO products they developed and E/PO activities they carried out, appears in appendix B. Appendix B also contains descriptions of a variety of special purpose space science E/PO programs such as the Initiative to Develop Education through Astronomy and Space Science (IDEAS) program, the Minority University and College Education and Research Partnership Initiative (MUCERPI) in Space Science, and projects initiated or coordinated by the NASA Space Science E/PO Support Network.

The work of the Space Science E/PO Support Network is essential to the success of the NASA Space Science E/PO Program. The network is comprised of four theme-oriented Education Forums and seven regional Broker/Facilitators. The Forums are charged with coordinating the E/PO efforts of individual space science missions and helping them to



The OSS E/PO Support Network consists of four theme-oriented Education Forums and seven regional Broker/Facilitators.

make their discoveries and results accessible and readily available to the education community. The Broker/Facilitators are charged with facilitating the involvement of space scientists in education through creating partnerships with educators to carry out high-leverage E/PO activities. Each Forum is responsible for supporting missions within one of the four space science research themes: the Astronomical Search for Origins (ASO), Solar System Exploration (SSE), Structure and Evolution of the Universe (SEU), and the Sun-Earth Connection (SEC). Each Broker/Facilitator is responsible for serving space scientists and educators within a specific geographical region.

Contact information for each of the Forums and Brokers/Facilitators and lists of the E/PO projects in which they were most substantially involved in FY 2003 are given in appendix B. For the many other projects in which they played the background role of catalyzing, coordinating, and facilitating the E/PO activities of others—as well as coordinating the reporting of those activities for this Annual Report—the work of Support Network members is not explicitly mentioned, but it is implicitly assumed and greatly appreciated. The work of the Support Network in coordinating activities and encouraging the involvement of space

scientists in E/PO is central to many of the successes described in this Annual Report.

The number of space scientists who participate in E/PO efforts is steadily growing. In FY 2003, more than 1,300 scientists, technologists, and support staff supported by the Space Science Enterprise contributed to E/PO efforts—a more than 25 percent increase over the number reported as contributing in FY 2002. Each of these dedicated individuals is acknowledged by name and affiliation in appendix C.

Partnerships with major institutions and organizations within the education and science communities continued to be a fundamental part of the Space Science Enterprise's approach to E/PO. In FY 2003, more than 530 institutional and organizational partners worked closely with the space science E/PO program to help create products and activities that meet the needs of educators and to provide multiplier effects that increase the size and diversity of audiences reached. Among these partners were:

- More than 40 education organizations, including such major organizations as the Mid-continent Research for Education and Learning (McREL), the Association of Science-Technology Centers (ASTC), the Challenger



More than 500 institutions and organizations partnered with OSS to develop and implement E/PO programs in FY 2003. (Credit: Southeast Regional Clearinghouse/Craig Anthony)

Center for Space Science Education, the National Federation of the Blind, and a number of school districts and boards

- 16 organizations promoting minority participation in science, including professional societies of minority scientists such as the National Organization of Black Chemists and Chemical Engineers (NOBCCHE), and the National Society of Black Physicists
- Nearly 50 community organizations such as the Girl Scouts, the Boys & Girls Clubs of America, and the Civil Air Patrol
- Nearly 40 libraries, library systems, and library associations
- Nearly 200 museums, science centers, and planetariums
- More than 90 science institutions and organizations
- More than 100 colleges and universities, including 34 minority institutions

A full list of these partners appears in appendix D. This list includes only those institutions and organizations that served as full partners by leading the E/PO efforts for space science missions or programs and/or by leading or contributing substantially to developing space science E/PO

products or activities in FY 2003. Taking into account another 1,900 institutions and organizations whose role was primarily that of serving as additional host sites for NASA space science E/PO events and exhibits, or as media outlets for NASA space science materials and programs, a total of more than 2,400 institutions and organizations participated in NASA space science E/PO efforts during FY 2003. Each such institution or organization is listed in appendix H according to its geographical location. This appendix also serves as an index, cross-referencing each institution or organization to the descriptions in appendix A or B of the programs, activities, or products with which they are associated.

Conferences provide an effective means of contact with organizations and individuals engaged in space science E/PO activities. In FY 2003, OSS had a substantial presence at more than 100 national or regional scientific and education conferences. Exhibits, workshops, materials, and knowledgeable staff were present at such conferences, which provided significant opportunities to discuss space science E/PO resources, opportunities, and issues with conference attendees. These conferences included more than 20 national education and outreach conferences organized

by groups such as the National Science Teachers Association, the International Planetarium Society, and the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers. Also included were nearly 60 regional education and outreach conferences sponsored by groups such as regional library associations and state science teacher associations, as well as nearly 20 science conferences at which OSS encouraged scientists to more actively participate in E/PO activities. A complete list of the conferences at which there was a significant space science presence in FY 2003 appears in appendix E.

One measure of the quality and impact of the NASA space science E/PO program is the public recognition that it received through more than 30 awards given to various facets of the program in FY 2003. A complete list of these awards is given in appendix F.

The space science E/PO efforts described here are only one component of a comprehensive Agencywide education program that is led by the NASA Education Enterprise. Contact information for the Education Enterprise and its representatives within the NASA Science and Technology Enterprises and at NASA Centers is given in appendix G.

The information contained in this FY 2003 Annual Report was compiled from data on activities entered into the NASA Education Evaluation Information System (NEEIS) and from information on new products registered in the [Space Science Education Resource Directory \(SSERD\)](#). This information was originally provided by the people responsible for each individual E/PO product or activity. Because the NASA Space Science E/PO Program emphasizes high-leverage approaches and is carried out through extensive partnerships undertaken in a decentralized way, the information that has been reported is bound to be incomplete. This Annual Report should therefore be regarded as a represen-

tative—rather than a comprehensive—compilation of NASA space science E/PO products and activities. The statistical information provided should be regarded as representing lower limits for the quantities reported.

The narrative sections of the report that follow begin by providing summary information on awards and other forms of public recognition that the OSS E/PO program received in FY 2003. The sections then provide statistical summaries and describe highlights of E/PO efforts in each of the following categories:

- **Science Center Shows/Exhibits:** planetarium shows and museum or science center exhibitions
- **Targeted Outreach:** activities that provide substantial targeted outreach to underserved/underutilized groups
- **Educational Products:** products designed for use in classrooms, for enhancing the public understanding of science, and/or for special interest groups
- **Educational Activities:** activities primarily intended to enhance formal classroom education, the public understanding of science, or the involvement of scientists in E/PO

The examples of products and activities cited in this narrative represent just a few highlights from the rich portfolio of products and activities that are fully laid out in the appendices. The main body of the report concludes with a discussion of program evaluation and a look at future plans for the NASA Space Science E/PO Program. Appendices and indices then provide comprehensive details and cross-references on all OSS E/PO products and activities that were reported for FY 2003. Live links and additional search capabilities may be found in the online version of this report at <http://spacescience.nasa.gov/education>, under the link to “Annual Reports.”

"This was great. It was like seeing a sky show on my PC."

— MUSE Award Judges on ViewSpace

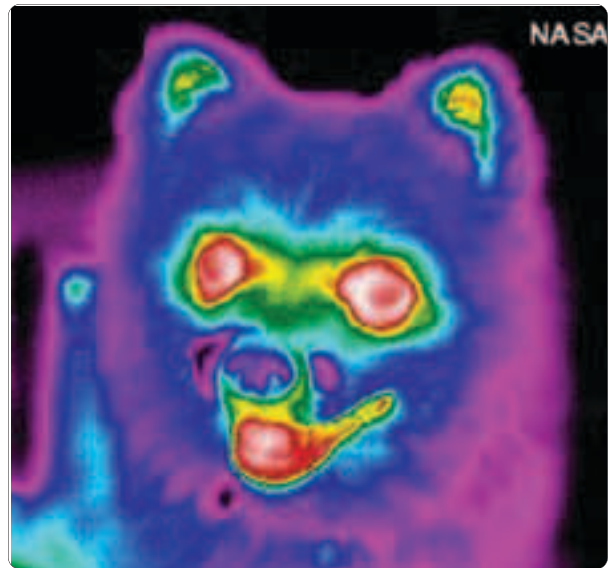
AWARD-WINNING PROJECTS

As was the case in previous years, the NASA Space Science Education and Public Outreach (E/PO) Program received more than 30 new awards or other forms of public recognition in FY 2003. While this number of awards is similar to the numbers received in previous years, the sources of these awards suggest that public recognition of the NASA Space Science E/PO Program is extending to audiences far beyond the community of science educators.

A Pacific Southwest Regional Emmy® Award in the Children/Youth Programming category was given to the NASA CONNECT program, *"Data Analysis and Measurement: Having a Solar Blast!"* In this program, students learned how NASA researchers are investigating the Sun-Earth Connection through four NASA space science missions—SOHO, ACE, IMAGE, and HESSI. Researchers from NASA Goddard Space Flight Center and the University of California at Berkeley were featured in the program. Program partners included the AIAA Foundation, the National Council of Teachers of Mathematics (NCTM), the U.S. Naval Observatory, the University of California at Berkeley, the Maryland Science Center (Baltimore, MD), Hardy Middle



Students used solar images such as this one from SOHO to investigate solar flares and the 11-year solar activity cycle. (Credit: SOHO - EIT Consortium, ESA, NASA)



"Infrared Dog", one of many infrared images of animals from the "Infrared Zoo" components of the "Cool Cosmos" Web site. (Credit: SIRTFF/IPAC)

School (Washington, DC), The Odyssey School (Baltimore, MD), the University of Maryland, the AIAA Washington, DC Professional Chapter, Riverdeep, and ePALS. Melissa Joan Hart was the program's featured celebrity. More information about NASA CONNECT is available at <http://connect.larc.nasa.gov>.

A Telly Award, one of the most prestigious honors given to non-broadcast videos and non-network television commercials, was given to the , *"Why Does the Moon Look Like It Changes?"* segment in the "Ask an Astronomer" series. "Ask an Astronomer", available at <http://coolcosmos.ipac.caltech.edu>, is a series of short video clips in which infrared astronomers give answers to questions submitted to the "Cool Cosmos" Web site. In *"Why Does the Moon Look Like it Changes?"*, carefully conceived 3D animations show how changing illumination from the Sun makes the Moon appear to change its shape. These videos, and the "Cool Cosmos" Web site, are a joint effort of the Spitzer Space Telescope mission and the California Institute of Technology's Infrared Processing and Analysis Center (IPAC).

Other awards received from organizations outside of the community of science educators include a Site of the Day award from "Good Housekeeping" magazine, given to the Navigator Program's *"PlanetQuest"* Web site at <http://planetquest.jpl.nasa.gov>; a Communicator Award of Distinction and a Communicator Award of Excellence, given to the Discovery Program's *"Unlocking the Mysteries: NASA's Discovery Program"* video; and Golden Web Awards, given to the Spitzer Space Telescope/IPAC "Cool Cosmos" Web site for its flash animation and to the NASA Astrobiology Institute (NAI) for its *"Astroventure"* Web site. In addition, the *"PlanetQuest"* Web site was designated by the Google

Web Directory as the “Top Ranked Site on Extrasolar Planets,” and the PlanetQuest “[Life Signs](#)” activity was designated as an Internet Scout Resource by the Internet Scout Project. Finally, the “[Infrared Yellowstone](#)” and “[Infrared Zoo](#)” components of the “Cool Cosmos” Web site were designated as “Top Sites” by Kids Online.

Of special note from within the science education community was an American Association of Museums Bronze MUSE Award, given to the Hubble Space Telescope’s [ViewSpace](#) project. [ViewSpace](#) is a multimedia exhibit program that uses a PC and a large-format display to show free-running multimedia presentations that combine high-resolution images, digital movies, and animations from HST and other NASA space science missions with interpretive captions and soothing space music. [ViewSpace](#) is continually updated via CD’s or over the Internet and made available free to science centers, planetariums, or museums to use in galleries of their own design. The Muse awards recognize outstanding achievement in museum media. In reviewing [ViewSpace](#), the MUSE judges said, “This was great. It was like seeing a sky show on my PC. And while

the images were spectacular, it wasn’t just about the images. The content was great, too—interesting, clear, well-presented, and wonderfully illustrated.” The MUSE producers added, “with the [ViewSpace](#) project we have found, to our delight, that museum audiences will linger for long periods and drink in Hubble’s amazing views of the universe. The essential accessory to our program is comfortable seats!”

The importance of the Space Science E/PO Program to NASA was recognized by a NASA Outstanding Leadership Medal, given to Dr. Jeffrey Rosendhal, Director of the NASA Space Science E/PO Program. This award is given for “notably outstanding leadership which affects the technical or administrative programs of NASA,” and it is a fitting tribute to the leadership role that Dr. Rosendhal has played in envisioning, initiating, and developing the NASA Space Science E/PO Program over the last 10 years.

A complete list of all the awards reported as being received in FY 2003 throughout the NASA Space Science E/PO program appears in appendix F.

"The magic for me is putting the live stuff into our daily programming. The planetarium truly becomes a place of learning."

— Jon Elvert, President, International Planetarium Society

SCIENCE CENTER SHOWS/EXHIBITS

Science centers, museums, and planetariums play a crucial role in carrying out NASA's goal of "engaging the public in shaping and sharing the experience of exploration and discovery". Through such venues, the discoveries and results from NASA space science missions can be effectively brought to millions of visitors each year. In FY 2003, significant attention was paid to improving the means by which the excitement of current space science missions could be brought instantaneously to hundreds of science centers, museums, and planetariums across the country.

In anticipation of the Mars Exploration Rovers (MER) landings and subsequent explorations of Mars in early FY 2004, NASA's Jet Propulsion Laboratory established a [Mars Visualization Alliance](#). Through this alliance, over 100 museums, science centers, and planetariums stood ready to receive MER images and information daily through a secure, dedicated Web site accessible only to Alliance members. This Web site was designed to ensure access for Alliance members even if the traffic on the agency's Web sites for the public exceeded their planned capacity. An e-mail notification system was designed to give each Alliance member updates on MER plans and breaking news from Mars, and a professional development program was created to give museum staff and docents access to background information and opportunities for discussions with mission scientists through teleconferences and conferences. With these resources available, each Alliance member planned to incorporate MER images and information into special events and live programs at their own facilities. A special location was set up on NASA's Web page to broadly advertise these events. In order to make all of these plans possible, the MER science team made an unprecedented commitment to release all of their images from Mars in near-real-time before even they themselves had a chance to study them. The reaction of International Planetarium Society President Jon Elvert speaks for the entire Alliance community: "The magic for me is putting the live stuff into our daily programming. The planetarium truly becomes a place of learning."



ViewSpace was selected for installation at the new Clark Planetarium in Salt Lake City .(Credit: Clark Planetarium)



A young visitor to "Cosmic Questions" gets a "feel" for the Milky Way's structure. (Credit:Smithsonian Astrophysical Observatory/)

Another major step towards bringing more timely material to science centers, museums, and planetariums was taken by the Space Telescope Science Institute's award-winning [ViewSpace](#) program. Based on the work done in prior years, the [ViewSpace](#) community had grown to encompass over 100 science centers, museums, and planetariums. Each institution had built a special gallery in which to continuously show [ViewSpace](#) programming to their visitors. Regular updates of the [ViewSpace](#) content were being delivered quarterly to each institution through CDs containing a new set of the high-resolution images, digital video clips, interpretive text, and space music that comprise the [ViewSpace](#) multi-media presentations. In FY 2003, a pilot program to improve the delivery speed and frequency of [ViewSpace](#) updates by delivering them over the Internet was initiated at eight [ViewSpace](#) sites. This Internet delivery allows much more frequent updating of the [ViewSpace](#) content—as often as several times a day when there is breaking space science news. In addition, the more frequent updating allows the [ViewSpace](#) content to include a much wider variety of subjects than was previously possible. Future content will include not only the images from Hubble Space Telescope, upon which [ViewSpace](#) was born, but also content from other NASA space science missions, including the Spitzer Space Telescope, the Cassini mission to Saturn, and, of course, the Mars Exploration Rovers (MER).

Engaging the public through the more traditional means of major museum and science center exhibitions and planetarium shows also continued in FY 2003. Some examples of the exhibitions and planetarium shows featuring NASA space science content that were on tour or showing at venues across

the country in FY 2003 are described below. More complete listings of them are given in appendix A.

More than a quarter million people visited the 5,000-square-foot exhibition, ["Cosmic Questions: Our Place in Space and Time"](#), during its 3-month opening run at the Museum of Science in Boston. ["Cosmic Questions"](#) challenges audiences to explore fundamental questions and recent discoveries about the origin, evolution, and structure of the Universe. After completing its opening, ["Cosmic Questions"](#) began a national tour under the management of the

Association for Science-Technology Centers with a stop at the Midland Center for the Arts in Midland, MI. ["Hubble Space Telescope: New Views of the Universe II"](#), an exhibition that features the best of Hubble's beautiful images and shows visitors how this suite of scientific instruments is challenging widely held assumptions about the cosmos, visited the Virginia Air and Space Museum in Hampton, VA, the Kirby Science Discovery Center in Sioux Falls, SD, the U.S. Space and Rocket Center in Huntsville, AL, and the Miami Museum of Science in Miami, FL, under the auspices of the Smithsonian Institution Traveling Exhibition Service (SITES). ["MarsQuest"](#), a 4,500-square-foot traveling exhibition that invites visitors to share in the excitement of the scientific exploration of Mars, completed its planned 3-year national tour with stops at the Lafayette Natural History Museum and Planetarium in Lafayette, LA, the Liberty Science Center in Jersey City, NJ, and the Boonshoft Museum of Discovery in Dayton, OH. An updated and revised version of ["MarsQuest"](#) will begin a national tour in FY 2004.

The ["MarsQuest"](#) planetarium show, originally released as a companion to the ["MarsQuest"](#) traveling exhibition, was shown in 23 different planetariums in FY 2003. By the end of the year, ["MarsQuest"](#) had played in 45 facilities around the world under the auspices of its producers, Loch Ness Productions and the Space Science Institute. Even greater distribution was attained by the ["Northern Lights"](#) planetarium show that was developed as a show kit for small planetariums by the Lawrence Hall of Science (LHS) and the NASA Sun-Earth Connection (SEC) Education Forum at the University of California, Berkeley. Released as part of the LHS' audience participatory program series, Planetarium Activities for Student Success (PASS), the ["Northern Lights"](#)



"Northern Lights" classroom activities include selecting ideal locales on Earth for aurora watching, determining the altitudes of simulated aurora, predicting aurora on other planets, spectrum studies, and aurora mythology. (Credit: Lawrence Hall of Science)

show uses images, videos, and activities to demonstrate the connectivity between our Sun and the Earth. Since its release in the early summer of 2002, "Northern Lights" has been distributed to more than 100 institutions nationwide.

Through programs such as those described above, a total of more than 350 science centers, museums, and planetariums participated in NASA Space Science E/PO efforts in FY 2003. While all of these institutions served as venues for exhibitions, planetarium shows, or other activities based on NASA space science content, nearly 200 of them partnered with the Space Science Enterprise in more substantial ways. Some of them contributed substantially to developing exhibitions or planetarium shows in cooperation with NASA space science missions. Others developed special galleries or put on special public events of their own design in order to bring programs such as those available from [ViewSpace](#) or anticipated from the [Mars Visualization Alliance](#) to their local audiences. While accurate audience counts are difficult to attain, our conservative estimates indicate that more than 2 million visitors to science centers, museums, and planetariums were engaged in programs and activities based on NASA space science missions in FY 2003.

“A diverse cadre of scientists, assembled from a broad range of institutions, is essential to the future success of NASA space science missions and research programs”

— Dr. Edward J. Weiler,
NASA Associate Administrator
for Space Science

TARGETED OUTREACH

NASA, through its Education Enterprise, has made a strong commitment to “increasing the number and diversity of students, teachers, faculty, and researchers from underrepresented and underserved communities in NASA-related science, technology, engineering, and mathematics fields.” The Space Science Enterprise endorses this commitment as being essential not only to the future vitality of our nation, but as being essential to the future of NASA space science. The NASA Space Science Education and Public Outreach (E/PO) Program is therefore engaged in a wide variety of efforts aimed at broadening the diversity of participants in NASA space science education and research programs. While encouraging the involvement of participants from underserved and underutilized groups is a facet of all space science E/PO projects, the projects categorized as “targeted outreach” are those projects that make such involvement their primary focus. Highlights from some of the FY 2003 targeted outreach projects are given below. Descriptions of these and other targeted outreach projects may be found in appendix A.

The NASA Minority University and College Education and Research Partnership Initiative (MUCERPI) in Space Science is a grants program, carried out in collaboration with the NASA Office of Education, that offers minority universities opportunities to develop academic and/or research capabilities in space science. The hallmark of this program—and perhaps the most important key to its success—is that the Space Science Enterprise plays an active role in providing guidance and in engaging the community of NASA-sponsored space science researchers to serve as active partners in collaborations with the minority institutions involved in the program.

The planned 3-year period of performance for the first cohort of minority universities to receive MUCERPI grants drew to a close in FY 2003. The 3-year progress reports submitted by these 15 institutions tell remarkable stories of success. Collectively, the 15 institutions engaged in research collabora-



Students from Southern University and Louisiana State University prepare to launch three student-designed and -built experiments aboard a high-altitude helium balloon.

tions with 10 NASA space science missions or suborbital projects and nearly 50 working partnerships with major space science research groups at universities, laboratories, and NASA Centers across the country. In academic programs, they established on their campuses 25 new or redirected space science faculty positions; 12 new or revised space science degree programs, for which nearly 100 students have signed up; and 68 new or revised space science courses, with a total enrollment to date of nearly 1,800 students. They also engaged in a wide variety of teacher training, precollege outreach, and public outreach programs. These successes clearly demonstrate that vibrant academic and research programs in space science can be built at minority institutions through serious partnerships with established space science researchers.

Also in FY 2003, a competitive solicitation was conducted for a second round of MUCERPI awards. As a result, 16 minority institutions, including 8 Historically Black Colleges and Universities (HBCU), 5 Hispanic-Serving Institutions (HSI), 2 Tribal Colleges and Universities (TCU), and 1 Minority-Predominant Institution (MPI), will begin MUCERPI projects in FY 2004. More than 50 research or educational institutions will be active partners in these projects. A list of the institutions involved is given in table 1.

Table 1: Institutions Participating in MUCERPI 2003**Lead Institutions****Historically Black Colleges and Universities**

Alabama A&M University
 Fisk University
 Hampton University
 Norfolk State University
 North Carolina A&T State University
 South Carolina State University
 Southern University, Baton Rouge
 University of the District of Columbia

Minority-Predominant Institutions

Medgar Evers College

Hispanic-Serving Institutions

California State University at Los Angeles
 California State University at San Bernadino
 University of Houston–Downtown
 University of Puerto Rico at Mayagüez
 University of Texas at El Paso

Tribal Colleges and Universities

Salish Kootenai College
 Southwestern Indian Polytechnic Institute

Partner Institutions**NASA Field Centers and Affiliates**

NASA Ames Research Center
 NASA Astrobiology Institute
 NASA Goddard Space Flight Center
 NASA Jet Propulsion Laboratory
 NASA Johnson Space Center
 NASA Langley Research Center
 NASA Marshall Space Flight Center
 Lunar and Planetary Institute

Other Research Institutions

Arecibo Observatory
 Lawrence Berkeley National Laboratory
 Lawrence Livermore National Laboratory
 Orbital Sciences Corporation
 Planetary Science Institute
 Smithsonian Astrophysical Observatory
 Thomas Jefferson National Accelerator
 U.S. Geological Survey, Flagstaff

Colleges and Universities

Alcorn State University
 Bennett College
 Borough of Manhattan Community College
 Boston University
 Bronx Community College
 Catholic University of America
 City College of New York
 College of Staten Island
 Harvard University
 Holyoke Community College of Massachusetts
 Hostos Community College
 Hunter College
 Johns Hopkins University
 LaGuardia Community College
 Louisiana State University
 Montana State University
 Pasadena City College
 Queensborough Community College
 Rice University
 Texas Southern University
 University of Alabama, Huntsville
 University of Alaska, Fairbanks
 University of Colorado at Boulder
 University of Maryland, College Park
 University of Maryland, Baltimore County
 University of New Mexico
 University of North Carolina, Greensboro
 University of Southern California
 University of Texas, Brownsville
 University of Virginia
 University of Wisconsin
 Vanderbilt University
 Virginia Institute of Technology
 Yale University

Science Centers, Museums, and Planetariums

American Museum of Natural History
 Houston Museum of Natural Sciences
 Insights Museum
 New Mexico Museum of Natural History
 Virginia Air and Space Center

Educational and Community Organizations

Back Bay Amateur Astronomer Association
 Raul Yzaguirre School (Brownsville, TX)
 South Carolina Governor's School
 Tejano Center for Community Concerns
 Virginia Beach Public Schools



Participants in “Exceptional Space Science Materials for Exceptional Students” workshops experience simulated impairments to enable better appreciation of learning difficulties. (Credit: Support Network Broker, Southeast Regional Clearinghouse)

Through a new NASA University Research Center established in FY 2003, a Hispanic-Serving Institution will provide critical support for a major future NASA space science mission. The University of Texas at Brownsville (UTB) [Center for Gravitational Wave Astronomy \(CGWA\)](#) will provide computational capabilities that will predict the forms of gravitational waves expected to be detected by the Laser Interferometer Space Antenna (LISA) mission, scheduled for launch in the next decade. In so doing, the UTB [CGWA](#) will train a new generation of scientists to work at the intersection of gravitational wave data analysis, astrophysics, and numerical relativity. The postdoctoral assistants, graduate students, and undergraduates at the UTB [CGWA](#) be placed squarely at the forefront of what is expected to be an entirely new and remarkably fruitful field of space science research.

Continued discussions with professional societies of minority scientists in FY 2003 led the Space Science Enterprise to make a greater commitment to involving professional-level underrepresented minority scientists and minority university scientists as scientists in space science missions and research programs. This is consistent with a strong recommendation of the NASA Space Science Advisory Committee’s Task Force on Education and Public Outreach (E/PO) that OSS “expand and intensify” its “pioneering efforts to attract and better integrate minorities into E/PO projects and into the mainstream of OSS science programs.” As a result, plans were made to sponsor “Chicago 2004: A Workshop to Foster Broader Participation in NASA Space Science Missions And Research Programs”. This workshop is aimed at bringing together NASA personnel, current OSS-funded scientists and educators, and a diverse array of scientists and educators who are interested in participating in future NASA space science missions and research programs. A specific goal of the workshop is to seed personal contacts among a much more diverse community of investigators than has traditionally been active in

NASA space science missions. In addition, all participants are expected to gain insights and contacts leading to a better understanding of how the NASA space science program is organized, planned, and conducted; how missions and research programs are conceived; how mission and research teams are formed; and how successful proposals are constructed. The workshop will be held at the Hilton Chicago on June 28–29, 2004.

Efforts to make space science accessible to special needs students continued in FY 2003 with a series of “[Exceptional Space Science Materials for Exceptional Students](#)” workshops coordinated by the Southeast Regional Clearinghouse (SERCH) Broker/Facilitator. At these workshops, educators of exceptional students and developers of NASA space science education materials are brought together to meld their knowledge of the diversity of exceptional classroom and audience needs with the wide variety of standards-based space science educational support materials available from NASA. Participants are encouraged to simulate a variety of disabilities using visual impairment goggles, hearing impairment simulators, and other materials and devices to simulate physical disabilities. Discussions regarding learning disabilities such as ADD and ADHD are held throughout the workshop. As a result, new ways to bring space science resources to exceptional students are found, and a network of exceptional educators and NASA mission-related personnel is created.



GSUSA workshop participants observe crust material samples to determine the history of a “mystery planet”. (Credit: NASA Jet Propulsion Laboratory)

In a continuing effort to inspire young girls to consider careers in science, mathematics, and technology, the NASA Solar System Exploration Forum at the Jet Propulsion Laboratory established a formal agreement with the [Girl Scouts of the USA \(GSUSA\)](#) on behalf of the NASA Space Science E/PO program. This agreement establishes collaboration in all areas of space science content with the goal of

making science comfortable and fun for Girl Scouts and their adult trainers, leaders, and volunteers. The collaborative effort includes providing content for existing and newly created GSUSA programs, including "Leader" magazine articles, workshops, Web site content, space books and booklets, and patch programs. It also serves as a pilot program that is expected to encompass all areas of NASA education in future years.

Through targeted outreach programs such as these, the diversity of participants in NASA space science programs continues to expand to an ever-wider set of communities. In this way, NASA's quest to explore the Solar System and the Universe beyond genuinely becomes the quest of all Americans.

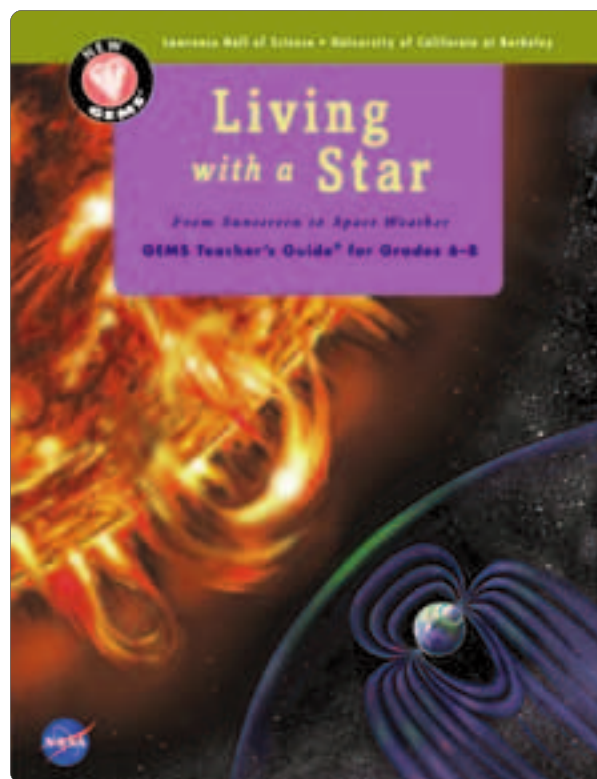
“To reach the next level of effectiveness, the NASA Space Science E/PO Programs create a Space Science Education Framework . . . a bridge between the science and mathematics of OSS missions and research and the needs of the educational system.”

— Space Science Advisory Committee
E/PO Task Force

EDUCATIONAL PRODUCTS

In FY 2003, 55 new education products were developed and registered in the NASA [Space Science Education Resource Directory \(SSERD\)](#). These products continued the tradition of using the unique appeal of space science missions and discoveries to enhance what is taught in the classroom. Most of these new products were developed by one or more NASA space science missions or researchers working in collaboration with professional educators and the NASA Space Science E/PO Support Network. With these additions, the total number of products registered in the [SSERD](#) at the close of FY 2003 was 440.

The users of these products have generally been very positive about them. Educators contacted by the Lesley University Program Evaluation and Research Group (PERG) “consistently report that they (and those they are educating) find space science to be exciting, engaging, and complex.” They also report that “resources and activities that feature space science engage students and give them motivation to learn scientific concepts in ways that less dramatic topic areas might not.” However, they also report some significant barriers to fully utilizing these classroom resources. The basic problem is that available resources exceed available time. With hundreds of space science materials available, but only very limited class time that can be devoted to space science, most of the materials may never actually be used. Educators require significant assistance in locating those materials that will best serve the particular points in the curriculum that they are tasked to teach.



In *Living with a Star*, students become solar scientists, studying fascinating aspects of the Sun and Earth and the critical connections between the two. (Credit: Lawrence Hall of Science)

To meet these needs, planning began in FY 2003 to develop a Space Science Education Framework. Developed in response to specific recommendations made by the NASA Space Science Advisory Council (SSAC) Task Force on E/PO, this framework would provide a bridge between the science and mathematics of NASA space science missions and research and the needs of the educational system. It would be aligned with the National Science, Mathematics, and Technology Standards, and it would provide a standards-aligned sequencing of space science topics throughout the K-12 years. Educators could use the Framework to quickly identify materials to use at specific points in the curriculum. Product developers could use the Framework as a guide to what materials might be most useful to concentrate on in the future. By the end of FY 2003, a Framework Leadership and Planning Group (LPG) had been established and given the mandate to provide a detailed conceptual plan for the Framework and commission its actual construction in FY 2004.

While the Framework is being constructed, the [SSERD](#) will continue to serve as the primary dissemination mechanism for NASA space science E/PO products. Hosted by the Space Telescope Science Institute at <http://teachspace-science.org>, the [SSERD](#) allows educators seeking materials to conduct searches by keyword, browse the directory by topic, or conduct advanced searches by using any combination of keywords, grade levels, formats, and subjects. The



The Space Science Education Resource Directory gives educators access to a wide variety of OSS E/PO materials.

products accessible by searches within the SSERD are only those for which wide-spread distribution mechanisms are readily available. At the close of FY 2003, those distribution mechanisms

were limited to electronic downloads or multimedia distribution on media such as CDs or videotape. Approximately three-fourths of the products in the SSERD were available through such means. Significant steps were taken during FY 2003 towards acquiring one or more commercial partners to provide low-cost distribution services for printed materials. It is hoped that such arrangements will become available during FY 2004.

One example taken from among the many new products released in FY 2003 is “[Living With a Star: From Sunscreen to Space Weather](#)”, a new NASA space science guide for middle school teachers that is part of the Lawrence Hall of Science’s Great Explorations in Math and Science (GEMS) series. Developed by the NASA Sun-Earth Connection Education Forum (SECEF) in collaboration with GEM, this guide allows students to explore the Earth’s dynamic relationship to the Sun through such vehicles as a space-weather mystery, a mock mission to outer space, and ultraviolet experiments.



Some of the 270 young Chicagoans who were happy to learn about Mars and NASA’s MER missions during “Countdown to Mars.” (Credit: Space Science Center for Education and Outreach, DePaul University)

Another example is “[Auroras: Mysterious Lights in the Sky](#)”. “[Auroras](#)” is directed at primary school children, as well as their parents and teachers (it includes a special section of science facts at the end of the book). The striking aurora images are real—in the online version they are from NASA spacecraft, and in the print version the images are photographs taken by Jan Curtis. A collaboration between SECEF and Ideum, the book was developed in conjunction with Sun-Earth Day 2003, whose theme was “[Live from the Aurora](#).” Further information on these and other new products released in FY 2003 appear in appendix A.

“I would really like to be into more science... I never thought science could be so exciting!”

— Student commenting on Space Day at DePaul University

EDUCATIONAL ACTIVITIES

Educational activities conducted by the NASA Space Science E/PO Program engage educators, students, and the public as directly as possible in space science missions and discoveries. Opportunities to conduct genuine research projects using real data and instruments, opportunities to learn about new discoveries as they are being made, and opportunities to interact directly with the scientists and technologists who are conducting the missions and research programs are emphasized. This direct contact with the content of NASA space science missions and research programs is a highly effective way to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics. In FY 2003, the NASA Space Science E/PO program conducted nearly 200 educational activities that directly supported classroom education at the precollege level, nearly 140 educational activities that were directed specifically to the general public, and nearly a dozen special activities aimed at encouraging members of the space science community to contribute to E/PO activities and at improving the effectiveness of their participation. Further comments on and examples of some highlights of these educational activities are given below. Detailed descriptions of these activities appear in appendix A.



The PlanetQuest activity kits contain essential items to aid amateur astronomers in conducting public outreach programs.

With the scheduled landing of the Mars Exploration Rovers (MERs) in early FY 2004, much attention in FY 2003 was focused on the anticipation of those landing events. “[To Mars with MER](#)”, a series of six hour-long public television broadcasts produced as part of the Passport to Knowledge program, had its debut broadcast “Countdown to Mars” on Space Day 2003 (May 1), from DePaul University in Chicago. Some 270 Chicago-area youngsters gathered at DePaul University for a day filled with hands-on activities and a live video link with MER engineers and scientists at NASA’s Jet Propulsion Laboratory (JPL). The broadcast of this event was hosted by Bill Nye the Science Guy and carried on than 120 Public Broadcasting Service (PBS) stations, reaching almost 2 million viewers. Nearly 300 e-mails came in during the broadcast that were answered in real time by MER scientists and engineers at JPL, Arizona State University, and Cornell University. The “[To Mars with MER](#)” project also includes videos, Web sites, hands-on activities and regional outreach events, all designed to inform and excite youngsters and general audiences about the science, engineering, and people of the MER mission.

The second broadcast in the series was a primetime documentary, “Bouncing to Mars,” that premiered on participating PBS stations in summer 2003. Many stations planned to air or rerun this “behind-the-scenes” story of the time-pressured development of the MER mission during the Fall as the actual MER landings drew closer. Two more programs for science centers, schools and planetariums and two more prime time documentaries for general audiences, timed to coincide with the MER landings and with the anticipated early science results, will complete the “[To Mars with MER](#)” series.

[Sun-Earth Day 2003](#) was celebrated on March 18, 2003 with thousands of participants at science museums, schools, and star parties in North America and Europe.

Participants learned about the beautiful displays of auroras (the Northern and Southern Lights), space weather, and catastrophic power outages, as well as the cultures of peoples living at northern latitudes. Two Passport to Knowledge programs supported the [Sun-Earth Day](#) festivities. “[Living With A Star](#),” a solar science documentary, was broadcast on February 11, 2003, in order to help prepare students for [Sun-Earth Day 2003](#). “[Live From the Aurora](#)” aired on Sun-Earth Day. This documentary used comments from Alaskan natives, a modern dance performance, and the most current science of auroras to introduce the Sun-Earth Connection. Original animation created by NASA’s Goddard Space Flight Center showed how physics and chemistry determine the shape and colors of auroras. The videos,



Workshop participants make pinhole camera measurements to calculate the Sun's diameter (Credit: Chabot Science Center)

broadcast nationally on participating PBS stations and NASA-TV, were accompanied by extensive Web-based activities and online resources developed by SECEF at Goddard Space Flight Center.

In anticipation of the Cassini-Huygens spacecraft's arrival at Saturn on July 1, 2004, the **Saturn Observation Campaign** was established by NASA's Jet Propulsion Laboratory to promote space exploration and prime the public for the deluge of stunning images and scientific data expected from Cassini-Huygens.

The **Saturn Observation Campaign** is open to amateur and professional astronomers, giving astronomers an opportunity to share their knowledge and passion for space exploration with their communities. Partnering with local organizations, volunteers use their imagination to hold fun and educational activities, such as viewing events, lectures, and hands-on activities.

Heading even farther into the solar system is the **New Horizons** spacecraft, scheduled to launch in 2006, fly-by Pluto in 2015, and then continue on to explore objects in the Kuiper Belt region beyond Neptune. On board **New Horizons** will be a student dust counter experiment, designed to detect dust particles produced by collisions between asteroids, comets, and Kuiper Belt objects. This instrument is being built entirely by students at the University of Colorado at Boulder; it will be the first science instrument on a NASA planetary mission to be designed, built, and flown by students. With faculty supervision, the students will also distribute data from the instrument and lead a comprehensive effort to bring their experiences to classrooms of all grade levels over the next two decades. The team plans to build high-school-level curricular modules on topics like Pluto and the Kuiper Belt, the role of dust in forming planetary rings, and designing space instruments. The student dust counter experiment is a result of remarkable foresight by the **New Horizons** principal investigator, Alan Stern of the Southwest Research Institute; the New Horizons science leader for E/PO, Fran Bagenal of the University of Colorado; and the Johns Hopkins Applied Physics Laboratory team that is building the spacecraft. The experiment, which will be used as a prototype for future missions, demonstrates that with careful advanced planning, spacecraft enhancements to facilitate major E/PO efforts can be built into the design and development of the spacecraft.



SSI E/PO workshop participants engage in the "Change Game," a simulation of school district education reform. (Credit: Space Science Institute)

Amateur astronomers provide a strong network for public outreach. To support the needs of amateur astronomers for materials and training to improve the effectiveness of their public outreach activities, the Navigator Public Engagement Program at NASA's Jet Propulsion Laboratory, the Astronomical Society of the Pacific (ASP), and the Astronomical League joined forces to create the [Night Sky Network](#). Astronomy clubs that join the [Night Sky Network](#) receive free outreach kits that are designed to be used in a variety of settings, including classrooms, youth group meetings, community college events, and outdoor star parties. Training in the use of the kits is provided through an enclosed training video and also through teleconferences and regional workshops provided by the [Night Sky Network](#). The first kit in the series is a [PlanetQuest](#) kit with hands-on activities and multimedia presentation materials. A second kit that will focus on the expanding universe and black holes is being developed in collaboration with the NASA Structure and Evolution of the Universe Education Forum at the Harvard-Smithsonian Center for Astrophysics.

Numerous workshops for individual teachers were conducted by the E/PO elements of OSS flight missions and research programs in FY 2003. These workshops offered teachers the opportunity to experience some of the excitement of conducting space science flight missions and increase their understanding of the discoveries made by such missions and research programs. In many cases, teacher guides and classroom activities based on the missions or programs were provided as part of the workshop.

["Beyond the Visible Universe: Teaching Invisible Astronomy"](#) was a series of 1-hour workshops presented jointly by the Spitzer Space Telescope and the Stratospheric Observatory for Infrared Astronomy (SOFIA) to raise educators' awareness of NASA's infrared astronomy research programs and their expected contributions to our understanding of the origin and evolution of the Universe. The workshops included information on future opportunities for educators to collaborate with astronomers and participate in conducting astronomical observations while flying onboard the SOFIA research aircraft. ["The Great Desert: Geology and Life on Mars and in the Southwest"](#) was a training workshop provided by the Lunar and Planetary Institute for grade 6 to 12 science teachers. It introduced the teachers to the geology and biology of Mars through analogies with similar features

on Earth. The workshop included both classroom learning and field studies at sites such as the Grand Canyon, Meteor Crater, and hot springs and faults along the Rio Grande Rift. In a completely different setting, the ["Towards Other Planetary Systems"](#) (TOPS) astronomy workshop provided teachers in Hawaii and the Federated States of Micronesia and the Marshall Islands with training in the use of remote telescope observing projects to teach science and mathematics. Under the guidance of the Deep Impact mission, the Hawaii Space Grant Consortium, and the Space Science Network Northwest Broker/Facilitator, the teachers received instruction in the astrometry and photometry of CCD images using image processing software, wrote research papers, and received training in operating portable STARLAB planetariums.

These are just a few examples of the hundreds of workshops that took place in FY 2003. Many of the workshops took place at major national educator conferences such as the National Science Teachers Association (NSTA) meeting in Philadelphia, PA, the National Council of Teachers of Mathematics (NCTM) meeting in San Antonio, TX, and the International Technology Education Association (ITEA) meeting in Nashville, TN. Typically, workshop presenters also staffed a major OSS E/PO exhibit booth, providing a place where teachers could examine materials and discuss them with the space science E/PO staff present at the booth. Teacher workshops were also conducted at regional educators conferences, at museums and science centers in conjunction with major NASA space science exhibitions, and at numerous other venues throughout the country.

Outreach efforts to scientists continued in FY 2003, with the goal of continually increasing the numbers of space scientists who contribute to E/PO activities and improving the effectiveness of their contributions. To this end, E/PO exhibits and/or workshops were displayed or conducted at eleven major meetings of scientists, including meetings of professional societies such as the American Astronomical Society and the American Geophysical Union. In addition, more extensive workshops for scientists interested in E/PO were conducted by the Space Science Institute. These workshops included both introductory sessions for "first-timers" and also more advanced sessions focused on special topics for those with more experience.

“The [NASA Space Science] E/PO program . . . has made remarkable progress in a relatively short period of time.”

— NASA FY 2002 *Performance and Accountability Report*

EVALUATION

Since its inception, the NASA Space Science Education and Public Outreach (E/PO) Program has closely followed the guidance provided in 1996 by an E/PO task force of the NASA Space Science Advisory Committee (SScAC) in its report, “Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy”. This report set forth the strategy for implementing a new space science E/PO program based on their conclusion that “in order to have a significant impact on improving the quality of science, mathematics, and technology education and the public understanding of science in the United States, OSS must take a comprehensive, integrated approach to implementing its education and public outreach programs.” The approach that they recommended centered on “high-leverage activities and the creation of partnerships between space scientists and education communities” in order to “amplify the efforts of individual scientists and ensure that limited funds and in-kind resources are channeled towards activities having the potential for state, regional, or national impact.”

In FY 2003, the final report was received from a second E/PO task force convened by SScAC to assess the progress that had been made in implementing a NASA Space Science E/PO program based on the recommendations of the previous task force report. This new report, “Implementing the Office of Space Science Education/Public Outreach Strategy: A Critical Evaluation at the 6-Year Mark”, was quite complimentary about the Space Science E/PO Program’s accomplishments and successes. Noting that the program “operates on the premise that achieving genuine success in affecting the quality of science, technology, engineering, and mathematics education in America will not be won through short-term activities with immediate results, but rather through a long-term commitment requiring a sustained effort in education and public outreach,” the Task Force cited the following specific accomplishments and successes:

- Direct engagement of OSS missions and the space science research community in education and in contributing to the public understanding of science;
- A rich harvest of educational programs and materials directed towards many types of audiences in diverse communities across the country;
- Significant steps towards involving minorities in the mainstream of OSS’s scientific, technical, and educational programs and in developing educational materials directed towards audiences that have not previously been served by NASA; and
- Substantial leveraging of resources through collaboration with hundreds of educational institutions and organizations across the country.

The task force also identified a number of areas “for particular attention” in future years—areas that they believed would “yield especially rich rewards in taking the OSS E/PO Program to even higher levels of maturity, effectiveness and accomplishment.” In summary, these areas are to:

- Make educational products more accessible and organize them in a more coherent way;
- Increase the inclusiveness of the program by involving new audiences, science topics, materials, and partnerships;
- Expand and intensify pioneering efforts to attract and better integrate minorities into E/PO projects and into the mainstream of OSS science programs;
- Enhance efforts directed towards quality control and obtaining a better understanding of program impact;
- Increase the effectiveness of the OSS E/PO Support Network by focusing the activities of the Broker/Facilitators on their primary roles;
- Strengthen and expand professional development efforts for E/PO professionals, scientists, and the education community;
- Enhance internal and external communications; and



Wyoming Astronomy Camp students making true-color images of the spiral galaxy M51. (Credit: University of Wyoming)



Dr. Paul Knappenberger of the Adler Planetarium and Astronomy Museum chaired the SScAC Task Force on E/PO. (Credit: Adler Planetarium and Astronomy Museum)

■ Identify and acquire critical resources required for long-term sustainability.

Many efforts to make improvements in these areas were already underway in FY 2003, and plans for increasing the emphasis upon them are discussed in the “Future Plans” section that follows.

Also in FY 2003, the Space Science E/PO Program’s external evaluators, the Program Evaluation and

Research Group (PERG) at Lesley University, continued their Phase III evaluation covering the period from October 2001 to October 2003. This phase of the evaluation laid the groundwork for the complex task of understanding the impact that the Space Science E/PO Program is having upon its intended audiences. Each of the various audiences that the Space Science E/PO Program serves has different needs, and impact therefore manifests itself differently within each group of users. Through interviews, surveys, observations, and other methods, the PERG evaluators collected data from each audience about its needs. The evaluators then began defining impact for each audience and detailing the attributes that effective resources would have for each audience.

From this information, the PERG group found that the Space Science E/PO Program was taking a number of steps that lead to positive impact. Asking for and utilizing input from users, providing more diverse and more meaningful E/PO activities for scientists, and forming partnerships between

audience members, scientists, and E/PO developers are among the positive steps that PERG cited.

A particularly important PERG finding was that a significant positive shift in the attitude of the space science community toward education had occurred. Contrary to the attitudes expressed when the program was just beginning, scientists now reported that they considered E/PO to be an important, albeit challenging, activity. This is a strong validation of the work that the Space Science E/PO Program has invested in making E/PO an expected part of every mission, and of the work that the Support Network (SN) has invested in encouraging scientists to become involved in E/PO and in helping them find ways to contribute more efficiently to space science education.

PERG also found evidence that NASA Space Science E/PO resources are reaching more diverse audiences, many of whom have been traditionally underserved by existing space science E/PO opportunities. This growing community of users is the result of efforts focused on reaching minority communities, students with disabilities, community-based groups, and minority universities.

PERG’s primary recommendation was that, in order to build upon the significant success and broad impacts found throughout the NASA Space Science E/PO program, information about the methodologies and lessons learned should be better disseminated throughout the E/PO community. In particular, PERG noted a need for more systematic and coherent dissemination of information throughout the Space Science E/PO community about user needs, existing resources, and current educational practices. Further guidance is also needed to help the E/PO practitioners better understand what constitutes success and how to measure and report it. These considerations form the basis for setting priorities for the planned improvements to the NASA Space Science E/PO program discussed in the next section.

"... genuine success ... will not be won through short-term activities with immediate results ... but rather through a long-term commitment requiring a sustained effort ..."

— Space Science Advisory Committee E/PO Task Force

SUMMARY AND FUTURE PLANS

The clear priority for FY 2004 is to improve the coherence of NASA space science materials for educators and product developers by building a space science curriculum framework. Such a framework will tell the story of space science "from origins to destiny," provide an appropriate standards-aligned sequencing of space science topics throughout the K-12 years, and link to recommended materials available for each point in the sequence. This will give educators coherent guidance as to what materials are available and how and when to use them, and it will give product developers guidance as to what new materials would be most useful to develop in order to improve and fill in the framework. During FY 2004, a leadership group established in FY 2003 will complete its task of conceptualizing in detail the design of the framework and forming a development team to begin work on building the framework itself.

With clear successes being reported by participants in the Minority University and College Education and Research Partnership Initiative (MUCERPI) in Space Science, attention will be given in FY 2004 to broadening the diversity of participants in NASA space science programs beyond the sphere of minority universities. In response to recommendations received from ongoing discussions with professional societies of minority scientists, an experimental workshop, "Chicago 2004", will be convened on June 28–29, 2004 at the Chicago Hilton. This workshop will bring together NASA personnel, current NASA-funded space scientists, and a diverse array of scientists who are interested in participating in future NASA space science missions and research programs. A specific goal of the workshop is to seed personal contacts among a much more diverse community of investigators than has traditionally been active in NASA space science missions. Hopefully, such contacts will lead to partnerships that will grow to become true collaborations as time goes on.

Opportunities for students and educators to engage in real research projects and to work with real data will continue to

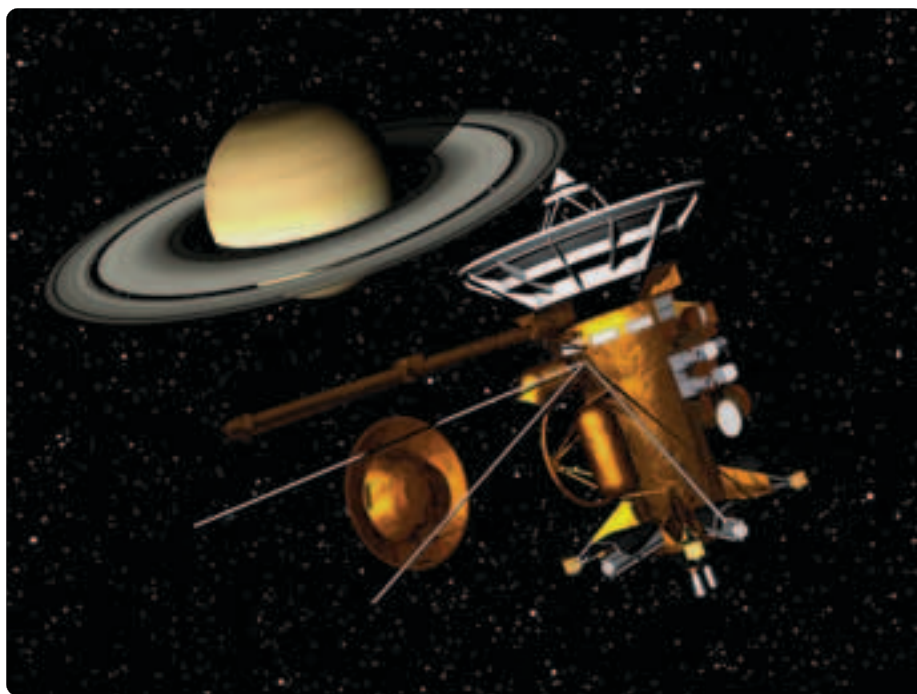


"Chicago 2004" will further extend opportunities for participation of minority scientists in space science missions.

expand as NASA space science missions, research facilities, and data centers devise new ways to provide such opportunities. For example, in conjunction with the January 2004 landings of the Mars Exploration Rovers (MERs), the Mars Public Engagement Program has created Mars Exploration Student Data Teams.

The Mars landings have been the highlight of NASA space science public outreach activities in FY 2004. Through the [Mars Visualization Alliance](#), more than a hundred science centers, museums, and planetariums have brought the excitement of the Mars landings and the subsequent science explorations to the public in near-real-time through special events held at each of their facilities. The Passport to Knowledge series has followed the progress of the Mars rovers through a series of special broadcasts for the education community and the general public. On January 17, "First Look" was broadcast live from the Houston Museum of Natural Science and NASA's Jet Propulsion Laboratory (JPL). Coming shortly after the January 3 landing of the first rover, "Spirit," the program focused on the initial science activities conducted by the rover. On May 1, "New Views from Mars"—an update on MER science activities—was broadcast from the St. Louis Science Center and JPL. These broadcasts, appearing on participating PBS stations and NASA-TV, were provided as a service to science centers, schools, and noncommercial media.

Later in FY 2004, Saturn will take center stage, with the Cassini-Huygens spacecraft arriving at Saturn and attempting to enter into an orbit around Saturn. For this event, the [Mars Visualization Alliance](#) will become a Saturn Alliance, giving the participating science centers, museums, and planetariums opportunities to hold special events to monitor and celebrate Cassini's orbital insertion, the subsequent scientific explorations of Saturn and its moons, and the unprecedented plunge of the Huygens Probe into the atmosphere of Saturn. The "[Ringworld](#)" planetarium show, for which distribution began late in FY 2003, will be a major feature at many of the participating planetariums during these major Cassini mission events.



In this artist's rendition, the Huygens probe is ejected by the Cassini spacecraft and begins its 22-day coast phase toward Titan. During the probe's descent through Titan's dense, murky atmosphere, the probe will beam data to the Cassini orbiter to be relayed back to Earth. (Credit: NASA Jet Propulsion Laboratory)

Major museum and science center exhibitions will continue to tell the space science story at venues throughout the country in FY 2004. The “Cosmic Questions” exhibition began FY 2004 at the Explorers Hall of the National Geographic Society in Washington, DC, which was followed by a stop at the Ontario Science Centre in Toronto, Canada. Version II of the “Hubble Space Telescope: New Views of the Universe” exhibition is visiting the Miami Museum of Science in Miami, FL; the Kalamazoo Aviation History Museum in Kalamazoo, MI; and the Arts and Industries Building of the Smithsonian Institution in Washington, DC. A newly renovated version of the “MarsQuest” exhibition, featuring the latest discoveries from missions, began its national tour in FY 2004 at the New Detroit Science Center in Detroit, MI. Joining “MarsQuest” on national tour in FY 2004 is new Mars exhibition, “Destination Mars”, which stops at the Sheila M. Clark Planetarium in Salt Lake City, UT; the Children's Museum of Durango in Durango, CO; and the Rocky Mount Children's Museum, Rocky Mount, NC.

An exceedingly rare celestial event, a transit of the Sun by the planet Venus, will occur in FY 2004. Starting at sunrise on June 8, 2004, Venus will be visible to properly prepared viewers as it moves across the face of the early morning sun. Information on safe viewing procedures, viewing locations, and times are available on the NASA Sun-Earth Connection Education Forum (SECEF) Web site at <http://sun-earth.gsfc.nasa.gov/sunearthday>. The Venus Transit will offer an opportunity to highlight the historical significance of such an event in making scientific observations that range from studying the atmosphere of Venus to determining the distance scale of the Universe. Resources available for students

and teachers will include a NASA/CONNECT TV program about how the transit of Venus set the scale of the Solar System; a Student Observation Network lab experiment on determining the distance from the Earth to the Sun using transit observations; and multi-curricular resources in science, math, history, literature, arts, and music. The entire transit will be Web cast by the Exploratorium from a site in Athens, Greece, and “Chasing Venus”—a special exhibition featuring materials and historical documents from past transits compiled by the Dibner Library of the Smithsonian Institution—will be on display at the National Museum of American History.

Other major activities anticipated for FY 2004 include developing E/PO program plans for major new initiatives such as Prometheus and Beyond Einstein, expanding relationships with community-based organizations such as the Girl Scouts of the USA, and investigating a variety of new potential partners for informal education and public outreach.

A coherent and sustained approach to providing professional development opportunities for the community of NASA space science E/PO providers will be initiated in FY 2004. Such professional development opportunities will be aimed at increasing the effectiveness of the many individuals who carry out E/PO activities for NASA space science missions



The Mars Rovers will provide exciting discoveries for many E/PO opportunities in 2004. (Credit: NASA Jet Propulsion Laboratory)



The transit of Venus will be the major Sun-Earth event of 2004.

and programs. Among the topics being considered for inclusion are training in standards and in the practical results from education research.

Evaluation will continue to be a major area of emphasis for OSS. The final report from Phase III of the PERG evaluation study is expected in FY 2004. Such evaluation reports have in the past proved to be extremely useful for guiding system-wide plans for continual improvement of the NASA Space Science E/PO program. Responding to recommendations from the anticipated PERG report and from the Space Science Advisory Committee's E/PO Task Force Report that was received previously will continue to be top priorities for FY 2004 and beyond.

The NASA Space Science E/PO program has now reached a new level of maturity. In prior years, the emphasis has been on establishing the program and finding out if the strategies upon which it is based are sound and productive ones. The evaluation reports now being received show that the strategies and implementation procedures are indeed sound. The emphasis in future years can therefore turn toward institutionalizing the program more firmly within the NASA Space Science Enterprise and developing ever broader collaborations throughout NASA and the external education community. The future for space science education is bright, and the Space Science Enterprise is pleased to be a major contributor to that future.

Appendices



